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ABSTRACT

Reported is a study of the effects of audio-tutorial chemistry instruction to determine if: (1) students will respond to post-course questionnaire items consistently within a category; (2) responses to items concerning equipment would be consistent within a category; and (3) attitudes towards educational materials would be consistent within a category. Analysis of the data showed that the first and third hypotheses were rejected, and the second was not. Recommendations for a correlational study of the relationship between students' disinterest in AT instruction and reasons for disinterest are given. A table presenting the tabulations of the responses to the post-course attitude questionnaire is included. Percentages have been calculated for each of the 70 items. (Author/SA)

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An Evaluation of Post-Course Student Attitudes in an Audio-tutorial College Chemistry Course

by

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INTRODUCTION

Increasingly, Audo-tutorial (AT) instruction is being used because it is perceived as a good facilitator of learning over a broad range of educational backgrounds. It is often hypothesized that students who invest sufficient amounts of study time will be able to achieve identical levels of competence regardless of their abilities and backgrounds. If this is true, it might be further hypothesized that AT instructed students should experience a positive attitude change toward the methodology and the subject matter. Audio-tutorial instruction then should be a positive educational motivator and tend to produce generally higher levels of competency than found in courses presented in a more traditional manner. Thus AT instruction would seem to be the final answer to the instructor's methodological woes.

Research results in these regards are mixed. Agarwal (1977) was able to support the first hypothesis. He found students enrolled in an AT college physics course able to demonstrate the same degree of competence regardless of their Piagetian stages. Pare (1973) and Butzow, Linz and Drake (1977) were unable to support either hypothesis. Pare (1973) concluded that, among students enrolled in a college physical science course, previous achievement was the best predicator of present achievement and attitudes toward the instructional situation. He further suggested that there was no strong relationship between attitude toward the AT method and course achievement.

Butzow, Linz and Drake (1977) replicated the study of Pare (1973) in a college chemistry course. They found pre-course achievement to be the best predicator of AT course achievement; and, in

addition, no significant change between pre and post course attitudes. However, there was a significant positive relationship (at .05) between both pre and post course attitudes and course final grade.

Since the AT method accommodates a large variety of learning styles, degrees of previous successes, abilities and the like, it is important to question why the methodology does not cause to be exhibited more positive post-course attitudes. The purpose of this experiment was to investigate inconsistencies in post-course attitudes toward audio-tutorial instruction. Three main hypotheses were investigated: (1) that students responses to methodologically orientated post-course questionnaire items would be consistent within that catagory; (2) that responses to equipment orientated questionnaire items would be consistent within that category; and (3) that attitudes toward educational material orientated questionnaire items would be consistent within that category.

METHOD

Setting of Instruction

Sophomore Marine Engineering students (93) at Maine Maritime Academy attended an introductory AT chemistry course orientated toward shipboard applications during the spring semester of 1978. [This was the same course evaluated by Butzow, Linz and Drake (1977).] All students received one course orientation lecture at the beginning of the semester during which course procedures, requirements, locations of equipment and other relevant information were discussed. The remainder of the course proceeded on an AT format.

Following the AT format, students worked in a laboratory setting where they listened to lectures on audio-tapes supported by 35mm slides, laboratory activities, and textual materials. When a student completed a unit of study he took an examination over the material

(all examinations were conducted on Thursday evenings); and if a minimum score of 90% was obtained, he proceeded on to the next unit of study. If the 90% competency level was not demonstrated, the student was required to take another examination during another testing session. Students were allowed to take as many exams as necessary to demonstrate minimum competency over a block of material. Final course grades were determined according to the scheme of Butzow, Linz and Drake (1977).

Evaluation Instrument and Procedures

The only instrument administered to the subjects was the seventy item post-course attitude questionnaire developed by Pare (1973) and used by Butzow, Linz, and Drake (1977) and Drake(1977). The items were of the Likert type, and five evaluation categories were provided. Those categories and their corresponding numerical scoring weights were: (1) strongly disagree; (2) disagree; (3) neutral; (4) agree; (5) strongly agree. Responses to questionnaire items were made on mark-sensetive answer sheets and machine tabulated to provide individual category counts and the mean score for each of the seventy items.

The questionnaire was divided into three groups and evaluations were made within each group. The evaluative groups were: (1) methodologically orientated questionnaire items, numbers 1, 3, 11, 12, 14 - 21, 23 - 26, 28, 29, 31 - 37, 39 - 42, 44 - 47, 50 - 54, 57, 66, 68, and 69; (2) equipment orientated questionnaire items, numbers 2, 10, and 67; (3) educational material orientated questionnaire items, numbers 4 - 9, 13, 22, 27, 30, 38, 43, 48, 49, 55, 56, and 70.

RESULTS

A tabulation of the results are presented in Table 1.

INSERT TABLE 1 ABOUT HERE

The response categories 1, 2, and 3 represent the evaluation groups 1, 2, and 3 listed above. The numbers in the columns strongly disagree, disagree, neutral, agree and strongly agree are the individual tallies of responses by category for each questionnaire item.

For further analysis, the tallies in the strongly disagree and disagree columns and those in the agree and strongly agree columns were lumped. The percentages of the total number of responses for each lumped group (some subjects failed to respond to all items) were computed. (See Table 2.) Table 2 includes all percentages arising from the lumping process; and in addition, the number of subjects not responding to each item.

INSERT TABLE 2 ABOUT HERE

When responses within each hypothesis category were evaluated according to lumped percentages, differential ratings were found between items for categories 1 and 3. In hypothesis category 1; responses to items 1, 14, 15, 16, 21, 24, 26, 28, 33, 39, 30, 41, 44, 45, 46, 47, 52, 54, 57, 59, 60, 62, and 65 were in general agreement with each other. Responses to items 3, 12, 17, 18, 19, 23, 25, 29, 31, 34, 36, 43, 50, 53, 61, 63, 64, 66, 68, and 69 were in agreement with one another but not in agreement with the first group, and items 11, 20, 32, and 51 were at or approached neutrality.

As with category 1, category 3 had two groups of items whose responses were generally related to one another. In this category, responses to items 4, 6, 27, 30, 48, 49, 55 and 56 generally agreed with one another; responses to items 5, 9, and 22 generally agree with each other, but did not agree with those in the first group; and items 7, 8, and 70 were at or approached neutrality. The responses to items 13 and 43 were not necessarily related either to the first or second clustering of items in category 3.

DISCUSSION

While hypotheses numbers 1 and 3 were rejected, the second hypothesis was accepted.

There were a number of factors which could account for the differential ratings within groups. With hypothesis category 1, and perhaps the entire investigation, the key item was probably number 1. Fifty-one percent of the respondants indicated they preferred not to partake of additional instruction presented in the AT mode. Accordingly, the primary reasons for students dislike of the AT method were that they felt it increased the number of distractions. They found it did not stimulate them to do their best work; the music used at certain points in the audio instruction was a waste of time; the AT method tended to isolate them from their classmates. They felt no one really cared whether or not they accomplished anything; there was less personal contact with the instructor than in more traditionally orientated courses; the audio tapes did not provide sufficient information for them; the lack of the instructor - authority figure prevented them from knowing whether or not they were doing well; they felt they would rather read than listen; the results of experiments should have been communicated prior to the conducting of the experiements; the AT course involved a lot of busy work; and the students had insufficient choice of experiments.

While there seems no general reason for the segregation of items in hypothesis category 3 into two clusters as the clusters relate to each other, the lumped percentage outcomes were related to questionnaire item 1. An additional suggestion for the reason why 51% of the students preferred not to have additional AT instruction was that they felt unable to pass the examination following the study of each module. Although it was true that some students could not pass an end of module examination

the first time, The actual amount of outside study these students accomplished prior to taking the examination was not investigated. Therefore there was no indication of personal time spent by students in independent outside study versus their score on end-of-module examinations.

The reasons for not liking the AT method may in part be related to the type of educational institution and the teaching methodologies used throughout the remainder of the Academy. Chemistry is the only AT course offered at Maine Maritime. The remainder of the instruction at the Academy incorporates the traditional lecture mode. Generally, Maine Maritime instructors (these instructors are also Academy Officers) are very strong authority figures. They are the deliverers or dispensors of knowledge and as such often project themselves as the ultimate academic authorities in their areas. Thus students of Chemistry become engaged in a teaching method quite radical when compared to their prior academic experiences, and so are unsure of themselves and therefore insecure. When students suggested that the AT mode tended to isolate them from their classmates, their perceptions were true. In the traditional course they could chat, joke, discuss and so on with their fellow students when a lecture was not in progress. However, in the AT course, they came and worked in the laboratory at their own convenience. This suggests a student might seldom be studying chemistry with the same group when in the lab.

Several items were related to the instructor - authority figure. Although there was an instructor in the laboratory whenever it was open, students failed to perceive that person as an instructor even though he or she was available to deal with students on a one-to-one basis. The possibility of personal contact with the instructor was, in reality, greater using the AT mode (maximum of 16 students studying at a time) than the lecture mode (30 - 35 students per lecture section), but because the instructor was not

lecturing the situation was seen in a different light. In the same regard, the deliverance of a lecture by the authority was seen as letting the student know how he was doing, a paradoxical stance at best. If one needed a lecture to help him decide how much individual progress was being made the AT method should have been ideal. All non-written material provided via the AT mode was recorded on audio-tape and instantly retrievable.

It is interesting that while a majority of the students felt that they had less contact with an instructor when using the AT mode, they seemed to have negated this by their majority agreement that they were able to get help whenever they wanted it. Another paradox seems evident since 51% of the respondants did not desire additional AT instruction yet 67% (a strong majority) liked working at their own speed.

The questionnaire dealt solely with attitudes toward the teaching methodology. While attitudes are important, they are ancillary to the real concern. That concern was whether the AT mode of instruction was a better facilitator of learning chemistry (for Maine Maritime Academy students) than some other method of instruction. Certainly, however, students attitudes toward the learning environment will effect the amount of learning gain which takes place in that milieu.

CONCLUSIONS

The major conclusions concerning the learning environment were three. A correlational study should be undertaken to ascertain whether there are positive relationships between the students' desire not to have additional AT instruction and the exposed reasons for this lack of interest. The learning environment should be modified so as to allow students one recitation hour each week with an instructor

(other educators offering AT courses should consider this change). The attitude questionnaire might better serve the needs of the investigator if the neutral category were removed.

In the last analysis, we must be careful about over interpretation of these results. The real answer regarding the use of one methodology over another as Postlethwait (1977) points out may fully depend upon the type of learning desired.

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TABLE 1

Tabulation of Responses to the Post-course Attitude Questionnaire

ITEM NO	CATEGORY	ITEM	STRONGLY DISAGREE (5)	DISAGREE (4)	NEUTRAL (3)	AGREE (2)	STRONGLY AGREE (1)	MEAN
1	1	I would like more instruction presented this way.	13	35	19	19	7	2.70
2	2	I learned more because equipment was available for me to use.	5	18	27	34	6	3.20
3	1	This instruction was very boring.	6	29	28	19	9	2.96
4	3	The material presented was of much value to me.	4	18	36	24	10	3.20
5	3	I was glad to get through the material.	4	5	13	30	40	4.05
6	3	The material presented will help me to solve problems.	6	17	35	29	5	3.11
7	3	I will be able to apply very little of the material which I have.	7	30	19	28	8	3.00
8	3	In view of the time available for learning, I feel that too much material was presented in this course	12	28	24	19	8	2.81
9	3	After studying a module, I could pass a written examination over the material which was presented without further instruction.	23	23	16	22	9	2.69
10	2	I was more involved with using equipment than with understanding the material	9	37	24	11	9	2.71
11	1	I became easily discouraged with this type if instruction	14	21	21	20	16	3.03
12	1	I enjoyed this type of instruction because I got to do experiments myself	6	17	24	37	8	3.26
13	3	I am not sure how much I learned while taking this course	4	21	29	28	11	3.23
14	1	This method of instruction increased the number of distractions possible	9	17	26	23	18	3.26

TABLE 1 CONTINUED

Tabulation of Responses to the Post-course Attitude Questionnaire

ITEM NO	CATEGORY	ITEM	STRONGLY DISAGREE (5)	DISAGREE (4)	NEUTRAL (3)	AGREE (2)	STRONGLY AGREE (1)	MEAN
15	1	This instructional method was not any more valuable than regular classroom instruction	9	20	22	29	13	3.18
16	1	I feel that I wanted to do my best work using this instruction method	9	30	25	19	10	2.90
17	1	This method of instruction made learning too mechanical	7	31	36	12	7	2.80
18	1	This method of instruction increased my ability to think	7	21	29	31	5	3.06
19	1	I feel that I was frustrated by the instructional situation	4	38	20	17	12	2.95
20	1	This was a poor way for me to learn science	10	20	21	24	16	3.18
21	1	To have music between experiments and at the end of the tape was a waste of time	6	14	25	17	30	3.55
22	3	I was interested in trying to find out more than the required amount about the subject matter which was presented	10	24	33	21	5	2.86
23	1	It was difficult for me to follow the order in this type of instructional method	9	33	20	20	10	2.88
24	1	This method of instruction tended to isolate me	4	17	29	33	7	3.24
25	1	It was helpful to have the objectives listed on the tape	2	6	11	44	28	3.99
26	1	I don't think I liked this instruction any better than other kinds I have had	10	19	27	21	15	3.13
27	3	The material presented was difficult to understand	10	39	17	21	6	2.72
28	1	This was a good way to learn this material	13	25	24	21	8	2.85

TABLE 1 CONTINUED

Tabulation of Responses to the Post-course Attitude Questionnaire

ITEM NO	CATEGORY	ITEM	STRONGLY DISAGREE (5)	DISAGREE (4)	NEUTRAL (3)	AGREE (2)	STRONGLY AGREE (1)	MEAN
29	1	I felt uneasy using this method of instruction	10	30	21	17	10	2.85
30	3	The material presented fit well with my previous knowledge of the subject	9	20	25	25	14	3.16
31	1	This method of instruction was a poor use of my time	14	28	20	18	12	2.85
32	1	While taking this instruction, I felt challenged to do my best	9	27	23	23	10	2.98
33	1	I disliked this method of instruction	7	26	17	26	17	3.22
34	1	The instruction gave me experience and not just talk	5	13	24	45	5	3.35
35	1	I learned very slowly with this type of instruction	5	27	28	24	7	3.01
36	1	I was always able to get help when I wanted it	5	17	10	37	23	3.61
37	1	This type of instruction made me want to work harder	13	32	28	12	8	2.68
38	3	It was hard to understand the material presented	6	37	24	19	6	2.80
39	1	This method was like having a tutor while taking the instruction	15	25	33	13	6	2.67
40	1	I felt no one really cared whether I worked or not	4	21	21	28	17	3.36
41	1	I think that there was less personal contact with the instructor than in other courses	13	13	10	36	21	3.42
42	1	I felt this type of presentation slowed me down	11	29	21	23	9	2.89
43	3	I think the material was too easy in this course	21	42	20	5	3	2.20
44	1	I felt that I gained more from having this kind of instruction than from other types of science courses	18	26	25	17	5	2.62

TABLE 2 CONTINUED

Tabulation of Responses to the Post-course Attitude Questionnaire

ITEM NO	CATEGORY	ITEM	STRONGLY DISAGREE (5)	DISAGREE (4)	NEUTRAL (3)	AGREE (2)	STRONGLY AGREE (1)	MEAN
45	1	This method of instruction was a valuable teaching device	12	20	37	15	8	2.86
46	1	This type of instruction would be more effective if the units were on a different subject	5	15	43	22	8	3.14
47	1	The tapes did not tell me enough	5	24	27	30	6	3.09
48	3	I like science courses	6	7	22	35	22	3.65
49	3	The objectives of this course were too vague	6	31	27	21	6	2.89
50	1	I liked working at my own speed	10	11	9	33	30	3.67
51	1	I would feel lost without a textbook	11	26	17	26	12	3.02
52	1	I could have worked better in a normal classroom	8	17	22	29	17	3.32
53	1	The course procedure made me feel at ease	4	13	18	43	15	3.56
54	1	I was not sure I was doing well without an instructor	6	20	33	27	7	3.10
55	3	I think that knowing how to analyze boiler water is important	2	3	4	21	59	4.48
56	3	I think that understanding boiler water treatment is important	2	3	5	18	62	4.50
57	1	I would like to have the use of a text be optional	11	15	33	21	13	3.11
58	1	The slides were helpful to me in performing the experiments	5	12	10	53	12	3.60
59	1	I would rather listen to taped instruction than read a book	23	31	19	12	7	2.45

TABLE 1 CONTINUED

Tabulation of Responses to the Post-course Attitude Questionnaire

ITEM NO	CATEGORY	ITEM	STRONGLY DISAGREE (5)	DISAGREE (4)	NEUTRAL (3)	AGREE (2)	STRONGLY AGREE (1)	MEAN
60	1	I think I should be told the expected results of experiments before doing them	5	18	19	30	18	3.42
61	1	Lectures on the topics to be covered would have been better than my doing experiments	21	31	23	12	5	2.45
62	1	I feel that this method involved a lot of busy work	4	23	24	34	7	3.18
63	1	I like the grading system based on units passed	6	16	18	33	20	3.48
64	1	I do not think end of module quizzes are necessary	12	37	21	14	9	2.69
65	1	I think there should have been more freedom of choice in experiments	3	12	33	31	14	3.44
66	1	I liked not being directed by an instructor	7	19	32	24	11	3.14
67	2	I felt that I often had to wait for equipment	16	44	9	13	10	2.53
68	1	I do not think there was enough time to complete things well	12	33	18	16	12	2.81
69	1	This method of instruction allowed me to better plan the use of my time	11	13	15	35	19	3.41
70	3	In the past, I have had difficulty in making connections between the experiments within units I have done in other sciences courses	9	19	42	19	4	2.89

TABLE 2

Percentages by Item For Lumped Groups

Item Number	Response Category	% Disagree Strongly Disagree	% Agree Strongly Agree	Number not Responding
1	1	51	27	0
3	1	38	30	2
11	1	38	39	1
12	1	25	48	1
14	1	27	44	0
15	1	31	54	0
16	1	41	31	0
17	1	40	20	0
18	1	30	38	0
19	1	63	31	2
20	1	45	43	2
21	1	21	51	1
23	1	45	32	1
24	1	23	44	3
25	1	18	79	2
26	1	31	39	1
28	1	41	31	2
29	1	45	30	5
31	1	45	32	1
32	1	39	35	1
33	1	35	46	0
34	1	19	54	1
35	1	36	34	2
36	1	23	65	1
37	1	48	21	0
39	1	43	20	1
40	1	27	49	2
41	1	27	61	0
42	1	43	34	0
44	1	48	24	2
45	1	34	25	1
46	1	21	32	0
47	1	31	39	1
50	1	22	67	0

TABLE 2 CONTINUED

Percentages by Item For Lumped Groups

Item Number	Response Category	% Disagree Strongly Disagree	% Agree Strongly Agree	Number not Responding
51	1	40	41	0
52	1	26	49	0
53	1	18	62	0
54	1	27	35	0
57	1	27	36	0
58	1	18	69	1
59	1	58	20	1
60	1	25	53	3
61	1	56	18	1
62	1	29	44	1
63	1	23	56	0
64	1	52	24	0
65	1	16	48	0
66	1	27	37	0
68	1	49	30	2
69	1	25	56	0
2	2	24	44	3
10	2	51	22	3
67	2	65	25	1
4	3	24	37	1
5	3	10	76	1
6	3	23	37	1
7	3	40	40	1
8	3	44	40	1
9	3	50	33	2
13	3	26	41	0
22	3	36	27	0
27	3	52	29	0
30	3	31	41	0
38	3	46	27	1
43	3	69	8	2
48	3	14	61	1
49	3	40	29	2
55	3	1	89	4
56	3	1	88	3
70	3	30	25	0